

CLAIMS

1. A hybridization detector comprising a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes, wherein the reaction region has a configuration for stretching the nucleotide probes by an electric field and for immobilizing the nucleotide probes by dielectrophoresis on scanning electrodes arrayed in the reaction region.

2. A sensor chip comprising the hybridization detector of claim 1.

15 3. A sensor chip comprising:
a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes;
counter electrodes generating a uniform electric field
20 for stretching the nucleotide probes in the reaction region;
scanning electrodes arrayed in the reaction region, the electrodes being capable of being energized; and
means for dielectrophoresis of the nucleotide probes stretched by the counter electrodes toward a pair of the
25 adjacent scanning electrodes by a non-uniform electric field

generated by applying a voltage between the adjacent scanning electrodes, and immobilizing the nucleotide probes in a stretched form so as to bridge the adjacent scanning electrodes.

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4. The sensor chip according to claim 3, wherein target nucleotide sequences are hybridized to the nucleotide probes immobilized between the scanning electrodes by dielectrophoresis of the target nucleotide sequences 10 stretched in the uniform electric field toward the scanning electrodes.

5. The sensor chip according to claim 3, wherein the scanning electrodes have circular or polygonal ends.

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6. The sensor chip according to claim 3, wherein the counter electrodes are disposed so as to oppose and be in parallel with each other.

20 7. The sensor chip according to claim 2, wherein the electric fields generated by the counter electrodes and the scanning electrodes are of alternate current.

8. A sensor chip comprising:

25 a reaction region for hybridization between nucleotide

probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes;

a common electrode disposed in the reaction region;

scanning electrodes formed of a plurality of electrodes

5 aligned in parallel; and

means for generating electric fields by sequentially applying a voltage between the common electrode and each of the scanning electrodes, dielectrophoresis of the nucleotide probes in the reaction region toward the energized scanning 10 electrodes while the nucleotide probes are being stretched by the electric fields, and immobilizing the nucleotide probes in a stretched form so as to bridge the scanning electrodes.

15 9. The sensor chip according to claim 8 comprising the common electrode and the scanning electrodes, wherein the scanning electrodes are aligned in two lines so that each end of the scanning electrodes opposes each other.

20 10. The sensor chip according to claim 9, wherein the scanning electrodes are disposed so that the distances between the opposing scanning electrodes increase stepwise in the direction that a voltage is sequentially applied.

25 11. The sensor chip according to claim 8, wherein the

target nucleotide sequences in a stretched form are hybridized to the nucleotide probes immobilized between the scanning electrodes by sequentially applying a voltage between the common electrode and the scanning electrodes, 5 and dielectrophoresis of the target nucleotide sequences in the reaction region toward the energized scanning electrodes while the target nucleotide sequences are being stretched.

12. The sensor chip according to claim 8, wherein the 10 scanning electrodes have circular or polygonal ends.

13. The sensor chip according to claim 8, wherein the electric fields generated by the common electrode and the scanning electrodes are of alternate current.

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14. A sensor chip comprising:

a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes;

20 first scanning electrodes arrayed in the reaction region;

second scanning electrodes arrayed so that the ends of the second scanning electrodes oppose the respective ends of the first scanning electrodes; and

25 means for generating electric fields by sequentially

applying a voltage between the adjacent electrodes of the first scanning electrodes and between the adjacent electrodes of the second scanning electrodes,
dielectrophoresis of the nucleotide probes toward the 5 energized scanning electrodes while the nucleotide probes are being stretched by the electric fields, and immobilizing the nucleotide probes in a stretched form so as to bridge the scanning electrodes.

10 15. The sensor chip according to claim 14, wherein the target nucleotide sequences stretched in the same manner as the nucleotide probes are hybridized to the nucleotide probes immobilized between the scanning electrodes by dielectrophoresis of the stretched target nucleotide 15 sequences toward the energized scanning electrodes.

16. The sensor chip according to claim 14, wherein the first scanning electrodes and the second scanning electrodes have circular or polygonal ends.

20 17. The sensor chip according to claim 14, wherein the electric fields generated by the first scanning electrodes or generated by the second scanning electrodes are of alternate current.

18. A sensor chip comprising:

a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes;

5 a common electrode disposed in the reaction region;

scanning electrodes arrayed so that the ends of the scanning electrodes oppose the common electrode;

means for generating electric fields by sequentially applying a voltage between the common electrode and each

10 electrode of the scanning electrodes and for

dielectrophoresis of the nucleotide probes toward the energized scanning electrodes while the nucleotide probes are being stretched by the electric fields; and

means for immobilizing the nucleotide probes in a

15 stretched form so as to bridge the scanning electrodes by

sequentially applying a voltage between the adjacent scanning electrodes.

19. The sensor chip according to claim 18, wherein the

20 target nucleotide sequences stretched in the same manner as

the nucleotide probes are hybridized to the nucleotide

probes immobilized between the scanning electrodes by

dielectrophoresis of the stretched target nucleotide

sequences toward the energized scanning electrodes.

20. The sensor chip according to claim 18, wherein the scanning electrodes have circular or polygonal ends.

21. The sensor chip according to claim 18, wherein the 5 electric fields generated between the common electrode and the scanning electrodes and between the scanning electrodes are of alternate current.

22. A method of hybridization using a hybridization 10 detector comprising a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes and scanning electrodes arrayed in the reaction region, the method comprising the steps of:

15 stretching the nucleotide probes in the reaction region by an electric field and immobilizing the stretched nucleotide probes on the scanning electrodes by dielectrophoresis; and

20 hybridizing the target nucleotide sequences to the immobilized nucleotide probes.

23. The method of hybridization according to claim 22, the method further comprising the steps of:

25 immobilizing first ends of the nucleotide probes on a selected single scanning electrode and subsequently

immobilizing second ends of the nucleotide probes on the adjacent scanning electrode so that the nucleotide probes bridge the adjacent scanning electrodes.

5 24. A hybridization detector comprising:

a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes;

10 counter electrodes disposed in the reaction region; and floating-potential electrodes being dispersed between the counter electrodes.

25. The hybridization detector of claim 24, wherein the floating-potential electrodes have a shape being capable of 15 generating a non-uniform electric field.

26. The hybridization detector according to claim 24, wherein each surface of the floating-potential electrodes is smaller than that of the counter electrodes.

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27. The hybridization detector according to claim 24, wherein the surfaces of the floating-potential electrodes are treated for immobilizing the nucleotides probes.

25 28. The hybridization detector according to claim 24,

wherein the counter electrodes are aligned in parallel with each other.

29. The hybridization detector according to claim 24,
5 wherein the electric field generated by the counter electrodes is of alternate current.

30. A sensor chip comprising at least the hybridization detector of claim 24.

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31. A method of hybridization using a hybridization detector comprising a reaction region for hybridization between nucleotide probes and target nucleotide sequences having a base sequence complementary to the nucleotide probes and counter electrodes disposed in the reaction region and a plurality of floating-potential electrodes aligned between the counter electrodes, the method comprising the steps of:

stretching the nucleotide probes in the reaction region
20 by applying a voltage to the counter electrodes and immobilizing the stretched nucleotide probes on the surfaces of the floating-potential electrodes by dielectrophoresis in non-uniform electric fields generated at the counter electrodes and at the partial surfaces of the floating-potential electrodes; and

stretching the target nucleotide sequences in the reaction region by applying a voltage to the counter electrodes, and hybridizing the stretched target nucleotide sequences to the stretched nucleotide probes immobilized on 5 the surfaces of the floating-potential electrodes.